Journal of Physics: Conference Series 2017 vol.929 N1

The method for celestial bodies' center of mass position relative to their figures determination on the basis of harmonic analysis of the expansion in spherical functions in order to refine the physical libration parameters

Demina N., Andreev A., Demin S., Nefedyev Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© Published under licence by IOP Publishing Ltd. In this paper the problem of the lunar center of mass relative to the center of its figure determination on the basis of space observations is considered, since the Moon is the most studied celestial object and there is a complete database on it. The future prospects for lunar laser ranging and radio interferometry require development of adequate theoretical support for modern technologies. The aim of these studies is the distances' measurement between the Moon and the Earth with an accuracy of 1 mm. Thus, determination of the lunar center of mass position, represented in this paper, and development of the selenocentric system will allow to solve the above mentioned problem more accurately and reliably. The new values of the lunar center of mass relative to its center of figure in orthogonal selenographic coordinate system Δξ, Δη, Δζ have been determined; they are: -1.75, -0.75, 0.11 km respectively.

http://dx.doi.org/10.1088/1742-6596/929/1/012013

References

[1] Rambaux N and Williams J G 2011 Celestial Mechanics and Dynamical Astronomy 109 85
[2] Williams J G, Boggs D H, Yoder Ch F, Ratcliff J T and Dickey J O 2001 Journal of Geophysical Research: Planets 106 27933
[3] Williams J G, Turyshev S G, Boggs D H and Ratcliff J T 2006 Advances in Space Research 37 67
[4] Dickey J O, Bender P L, Faller J E, Newhall X X, Ricklefs R L, Ries J G, Shelus P J, Veillet C, Whipple A L, Wiant J R, Williams J G and Yoder C F 1994 Science 265 482
[5] Williams J G, Boggs D H and Folkner W M 2008 Jet Propulsion Laboratory (California Institute of Technology) Interoffice Memorandum
[6] Nefedyev Yu, Valeev S, Mikeev R, Varaksina N and Andreev A 2012 Advances in Space Research 50 1564
[7] Andreev A O, Demina N Y, Demin S A, Nefedyev Y A and Churkin K O 2016 Nonlinear Phenomena in Complex Systems 19 271
[8] Rizvanov N G, Nefed'ev Yu A and Kibardina M I 2007 Solar System Research 41 140
[9] Nefedjev Yu A and Rizvanov N G 2002 Astronomische Nachrichten 323 135
[10] Smith D E, Zuber M T, Neumann G A and Lemoine F G 1997 Journal of Geophysical Research: Planets 102 1591
[11] Araki H, Tazawa S, Noda H, Ishihara Y, Goossens S, Sasaki S, Kawano N, Kamiya I, Otake H, Oberst J and Shum C 2009 Science 323 897

[12] Nefedyev Y A, Bezmenov V M, Demin S A, Andreev A O and Demina N Y 2016 Nonlinear Phenomena in Complex Systems 19 102
[13] Chuikova N 1975 Astronomicheskii Zhurnal 52 1279
[14] Valeev S G 2001 Regression modeling for data processing (Kazan: FEN) 1-296
[15] Lawson C L and Hanson R J 1995 Solving Least Squares Problems (Philadelphia: Society for Industrial and Applied Mathematics) 1-336
[16] Gubanov V S 1997 Theory and Application in astrometry (SPb.: Science) Generalized Least Squares 1-318
[17] Archinal A, Rosiek M R, Kirk R L and Redding B L 2006 U.S. Geological Survey: Open-File Report 1
[18] Araki H, Tazawa S, Noda H, Tsubokawa T, Kawano N and Sasaki S 2008 Advances in Space Research 42 317
[19] Demin S A, Panischev O Y and Nefedyev Y A 2014 Kinematics and Physics of Celestial Bodies 30 63
[20] Demin S A, Panischev O Y and Nefedyev Y A 2014 Nonlinear Phenomena in Complex Systems 17 177
[21] Demin S A, Panischev O Y and Nefedyev Y A 2015 Journal of Physics: Conference Series 661 012003
[22] Sokolova M, Kondratyeva E and Nefedyev Y 2013 Advances in Space Research 52 1217